THE ALLIANCE FOR THE CHESAPEAKE BAY

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BUILDING A BETTER GRASS BED

≈ Millions of seeds sown along with hopes for reaping hundreds of underwater acres

Warren Teets used to be a civilian employee of the Air Force until he tired of wading through 200 e-mails a day and retired, then headed to the Eastern Shore, where he got his captain's license. One day last year he was painting his house when a friend came by and asked if he wanted to get his feet wet by mowing grass—in the water.

"Sure, why not," Teets said, paintbrush in hand. Soon he was piloting a small, slow, but highly maneuverable boat with paddle wheels on each side that is designed to mow the underwater grasses that filled boat channels or surrounded docks.

This June, he was piloting the boat off Crisfield, MD, mowing his way through underwater grass beds. But rather than eliminating the grasses, he was trying to help them proliferate. The blades on the front of the boat were set to cut the top portion of the plants—reproductive shoots packed with seeds.

The goal was to collect seeds from a healthy bed for planting in areas with no grass at all; it's sort of like harvesting seed corn for a barren field. Historically, planting grass beds in the Bay has entailed digging up plants at one site and replanting them someplace else—one plant at a time, often by workers using scuba gear. Historically, not much grass got planted in the Bay.

That changed last year when the harvester collected millions of seeds. Instead of sowing plants one at a time, biologists tossed seeds into the water by the millions, covering nearly 100 acres of Bay bottom. Nowhere in the world are seagrass restoration efforts taking place on such a scale.

Warren Teets mows underwater grass beds off Crisfield, MD, as he collects the seed heads for restoration projects. Photo by Peter Bergstrom

The National Oceanic and Atmospheric Administration's Chesapeake Bay Office, the Army Corps of Engineers and the Keith Campbell Foundation are spending a combined $500,000 annually over three years for projects in Maryland and Virginia to try to perfect the large-scale planting technique—the largest ever investment in seagrass restoration in the Chesapeake.

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The reason why biologists want to find a way to expand grass beds was evident by looking at the conveyor belt of the harvesting boat, which pulled freshly cut grass out of the water. Along with the grasses were creatures that thrive in the underwater meadow: pipefish, small blue crabs, sea horses, croakers, baby terrapins. Bigger fish and crabs tend to evade the harvester, Teets said, although some 7-inch blue crabs have been turned up.

When the conveyor belt was filled, a Maryland Department of Natural Resources boat pulled up to load the grass. Workers packed the harvested blades into mesh bags, which were shuttled to a nearby marina for temporary storage. The bag stuffers, too, were aware of what may lurk among the grasses: Most wore gloves to guard against bites, pinches and other aquatic assaults.

Lush underwater grass beds are one of the most important building blocks of the Bay ecosystem. They are nurseries for juvenile fish and crabs—some studies suggest blue crabs may be 30 times more abundant in grass beds than in adjacent unvegetated areas. They put oxygen into the water, and filter nutrients and sediment out of it. They buffer shorelines against waves, reducing erosion.

But pollution in recent decades has overwhelmed grass beds. Algae blooms spurred by excess nutrients and sediment eroding off the watershed clouded the water, preventing sunlight from reaching the grasses. Unless 20 percent of the sun-

light hitting the water surface can make it to the leaves of eelgrass, the plants will die.

More than 200,000 acres of grasses may have once thrived in the Bay, but that number has been greatly diminished in the past half century, with Tropical Storm Agnes delivering the coup de grace in 1972.

By 1983, only 38,000 acres of grass beds were left in the Chesapeake. That number has increased Baywide, hitting 72,935 acres last year, which is still well below the Bay Program's restoration goal of 185,000 acres. But the story for eelgrass—which tends to require more light than other Bay species—has been particularly disappointing because it has hardly rebounded at all in many areas.

Eelgrass is particularly important in the Bay because it is the dominant—often only —species in high-salinity areas. And because it is present year-round, unlike some underwater grasses, it is a full-time provider of food and habitat, as well as an ever-present guardian against shoreline erosion.

That made the seeds Teets was harvesting a prized commodity. If they can help transform large areas of barren mud flats into lush grass beds, it would be a boon for the Bay.

Splash! Into the water went a brick, tethered to a pair of bags stuffed with plants, and a buoy. The brick fell to the bottom of the Potomac River as an anchor, while the buoy kept mesh bags stuffed with seed-filled eelgrass shoots afloat in the water. Each pair of bags had about 10,000 eelgrass seeds that had been harvested across the Bay at Crisfield a few days before.

In the coming weeks, as the tides ebb and flow, the seeds and plant material will gradually slip out of the mesh and sink to the bottom—dispersing much as nature would do if a eelgrass bed was rooted there to begin with.

"When we come back a month from now, all of these bags will be empty," said Tom Parham, a DNR biologist, as he and a waterman hired by the DNR methodically dispatched a brick, tied to a bag and buoy, every 30 feet as the boat zig-zagged across a pre-selected plot.

The site was selected for seeding because monitoring conducted for the past three years showed that the site should have enough water clarity to support the plants, and test plots planted by hand had survived. The hope is that new plants germinated from the fresh seeding will do the same.

The site was also selected because no eelgrass has been found in the lower Potomac for decades, although records indicate it was once abundant. With no eelgrass in the vicinity, it's unlikely it will be back anytime soon if things are left to the whims of nature as there is no natural source of seeds.

After the shoots, left, are harvested, volunteers pack them into bags to take back to the marina for temporary storage. Photos by Peter Bergstrom

For more than two decades, efforts to bring underwater grasses back to such barren areas typically relied on digging plants up in one place, and planting them in another, usually by a diver wearing scuba gear.

It was long, tedious work. Plots of less than an acre could take days, if not weeks of work. Then biologists would wait to see if the grass grew. Often it didn't. Only a fraction of the grass beds planted in the Bay have survived for several years.

Bob Orth, a seagrass expert with the Virginia Institute of Marine Science has estimated that as little as 1 percent of his grass planting projects over the past 25 years have proven successful. But one of his biggest successes came not from the laborious task of planting grasses by hand, but by tossing handfuls of seeds off the back of a boat.

In a coastal bay off Virginia's Eastern Shore, Orth and colleagues have gotten nearly 50 acres of grasses to take root since the late 1990s; beds that not only persist but get denser by the year and are spreading seeds to nearby areas.

If such techniques can be perfected in the Bay, it could mean that large-scale restoration done by broadcasting seeds might replace the painstakingly slow

transplant methods of the past, where big projects were often measured in square yards, not acres.

"There were years in the past where five acres weren't planted in the entire Bay," said Mike Naylor, a DNR biologist. "You would have been talking about a month of work."

By contrast, Parham's crew, along with a team working in another boat, "planted" five acres of seeds in about an hour.

Big, 20,000-gallon concrete tanks at the Piney Point Aquaculture Facility on the Potomac River are filled with the seed-laden grass clippings mowed down by Teets and stuffed into bags by DNR and Maryland Conservation Corps workers across the Bay.

Water is circulated through the tanks, spiked with a healthy dose of salt—the Potomac River water piped into the tanks is less salty than the water off Crisfield, and biologists want to maintain the salinity to give the seeds their best chance of surviving. "We go through a truckload of salt every three days," Parham said.

Unless the material is being planted using the mesh-bag technique, it will stay in these tanks until the seeds are ready to drop off. At that point, water is piped to a large, sieve-like table—sort of like an Old West gold mining operation—where the seeds will drop out the bottom so they can be collected and stored for planting in the fall.

In nature, eelgrass seeds are dispersed in the spring, similar to the technique being applied in the Potomac. But those seeds don't actually germinate until the fall. So biologists in Maryland and Virginia are testing the mesh-bag dispersal method in the spring, while simply broadcasting seeds into the water this fall to see which technique works better.

There are pros and cons to each technique. The mesh bags seem to mimic what happens in nature, but dispersing seeds in late spring leaves them exposed to such things as predators and sediment burial for months. Storing them until fall means more expense as workers try to maintain perfect conditions in the hatchery; last year, many seeds died.

Using either technique, the vast majority of planted seeds will never sprout. Seeded beds in the Bay tend to be sparse, and beds with germination rates as high as 5 to 10 percent are rare. Meanwhile, beds with germination rates of less than 1 percent are not unusual.

Exactly why germination rates are so low is unclear, but factors such as differences in sediment type, predation and wave action may play a role.

This year's planting projects are testing denser seed distribution—up to several hundred thousand seeds per acre—to see whether more seeds translates into more plants. But if water quality is maintained, biologists hope the few plants that survive will produce and broadcast their own seeds, eventually forming vast beds for crabs and fish.

"The success of these projects is not about how many of these seedlings come up," Naylor said, "it is about whether or not there is a healthy population of eelgrass five years from now."

The Bay Program has a goal of planting 1,000 acres of grass beds by 2008 a measure that has no chance of being met unless large-scale seeding is successful.

Half of this year's 30-million seed harvest will be shipped to the Virginia Institute of Marine Science as part of an exchange program—VIMS used the harvester last year and shared seeds with Maryland. Bob Orth, whose work off the Virginia coast spurred the interest in large-scale restoration, is overseeing the planting of the seeds in Virginia's portion of the Bay, but is guarded in his expectations.

While low-salinity grasses have been

In addition to the grasses, the harvester's conveyer belt brought up the creatures that thrive in the underwater meadow: pipefish, top, seahorses, left, and baby terrapins, above. Photos by Peter Bergstrom

Some of the shoots are packed in mesh bags tethered to buoys. They are tossed into the water, where it is hoped that the seeds will be dispersed like they are naturally. Photos by Peter Bergstrom

rebounding in the Upper Bay, eelgrass levels in the high-salinity areas of the Bay where he works have been largely stagnant for more than a decade.

Past restoration sites

haven't fared well, either. Orth was a pioneer in underwater grass restoration in the 1980s, but has seen healthy transplanted beds persist for years only to be washed away in a single storm. "I thought we were going to bring all of these grass beds back," Orth said. "We haven't."

Large-scale techniques have been tried in the Bay before. In 2001, the Chesapeake Bay Foundation tested a boat from Florida with 9-foot metal wheels that injected a plant into the sediment every three feet. It planted an acre of the Rappahannock River in a day, while Orth and colleagues hand planted eelgrass nearby to compare success.

Every plant from both techniques died during the surge of nutrients and sediment that was swept into the Bay in 2003. "People like to think that they can apply agricultural techniques to some of this, but it may not work," he said.

No restoration efforts can match what water quality does to—and for—grass beds. Between 2002 and 2003, the Bay lost 27,000 acres of grass beds. Between 2003 and 2004, it gained back 11,000 acres. Such year-to-year variation dwarfs even the once unimaginable "large-scale" plantings totaling 100 acres envisioned for this year.

"All you have to do is look at our numbers to see how quickly our grass beds decline and increase," Orth said. "The numbers are an order of magnitude more than what we could ever plant."

Yet continued tests with new techniques are warranted he said, in part because areas such as the lower Potomac and Rappahannock may not get eelgrass back for decades without successful plantings. This fall, the VIMS crew will experiment with an aquatic plow borrowed from researchers in Rhode Island that will allow seeds to be incorporated into the sediment rather than scattered on the surface. They will compare the results with those of a nearby area where seeds were broadcast.

Orth is also experimenting with taking about a dozen seeds, sewing them into inch-square burlap bags and anchoring them into the sediment. That has yielded promising results—more than half of the seeds produced plants. That's considerably more work and expense than than simply broadcasting seeds into the water.

"But we have to ask ourselves, if you have collected millions of seeds and only thousands survive, if you find a methodology that increases that an order of magnitude, maybe it's worth it even if it involves an extra step," he said.

Back at Crisfield,

Peter Bergstrom pulled clippings from Teet's harvester, which looked almost as if they were freshly mowed from someone's lawn. "It doesn't smell like grass clippings. It smells like a salt marsh," he noted.

Among the clippings is a diamondback terrapin barely an inch long. The terrapin is a reminder of the crucial nursery role that grass beds play. With no grasses around, such tiny creatures have no place to hide from bigger predators.

"You can see how many crabs, seahorses and turtles are in those grass beds," said Bergstrom, a biologist with NOAA's Chesapeake Bay Office. "What we are doing is helping to bring those critters to places like the Potomac, which haven't had the grass beds."

That's true even if the seeded beds wash away several years from now. "If your goal is to provide habitat, a couple years of good habitat is worth something," he said. "It still provided habitat when it was there."

And, just maybe, even if the bed does disappear, it may leave some seeds behind that will sprout again when the conditions are right. ≈